

### **REMARKS**

Amendments are made to claim 1 and 2 and new claim 18 is presented. The amendment to the preamble of claim 1 clarifies the nature of the "article" being transformed in the claimed method. Further, the amendment to the latter part of claim 1 more clearly defines the regularized residual sum of squares. Dependent claim 2 is amended to be more consistent with claim 1.

New claim 18 is an apparatus claim.

**The rejection of claims 1, 2, 5, 6 and 10 to 17 as not falling within one of the four statutory categories of invention is traversed and has been overcome by amendment.**

Amended claim 1, on which claims 2, 5, 6, and 10 to 17 depend, recites a method to transform multispectral image which is an "article" that comprises multispectral image data, where the data is a representation of one or more spectral values recorded for each point (pixel) in the image. As described in the specification, this image may be captured from an infrared (or other) scan of an area of the Earth. This "article" is transformed into identified (estimated) spectral values termed "endmember spectral values", which represent spectral components making up the multispectral image and thus are descriptive of the image. These endmember spectral values are articles in that they are reproducible, non-abstract and are useful. The claims also recite a transformation in which the mixing proportions of each estimated endmember spectral values present in the multispectral image. This is a transformation type of process and therefore statutory subject matter.

New claim 18 recites an apparatus that includes a data processor and is therefore statutory subject matter. The recitation for a data processor in claim 18 is supported in the original application which describes “processing the data.” Spec. para. 0016. There are numerous other references which imply that data processing is performed by a suitable data processor, such as for example paragraph 22 which refers to “programming”, paragraph 24 which describes the image data as being acquired from a multispectral scanner, paragraph 32 which refers to “computationally convenient”, paragraph 41 which states that “how much each endmember is represented in each pixel..” can be represented as “images/maps”, and paragraph 42 refers to “rerunning the algorithm to see whether fitting can be improved.”

**The rejection of claims 1, 2, 5, 6, 10, 11, 12, 13, 14, 15, 16 and 17 as being obvious over Keshava et al (“Spectral Unmixing”, IEEE Signal Processing Magazine – “Keshava”) in view of Sunshine et al (USP 6,608,931 – “Sunshine”) is traversed and has been overcome by amendment.**

The rejection for obviousness for at least the reason that Keshava does not disclose a “**regularized** residual sum of squares” which is recited in the claims. In particular, a “regularized residual sum of squares” as recited in the claims is not equivalent to a “residual sum of squares” and in particular the minimization process to find the “abundance vector” and the “shrink-wrap” process to find the endmembers as described in Keshava. To emphasize the significance of the term “regularized”, claim 1 has been amended to state that “wherein the regularized residual sum of squares comprises a sum

of a residual sum of squares and a measure of the size of the simplex, the residual sum of squares being reflective of a difference between the multispectral image data and a calculated value based on the estimated mixing portions and the estimated spectrum of each endmember." This amendment makes clear that the claimed "regularized residual sum of squares" comprises the sum of a residual sum of squares and a measure of the size of the simplex.

Claim 1 requires repeating the estimation steps. This is necessarily the case because of the "repeat ... until" language. Keshava does not teach or suggest "repeating the estimation of the mixing proportions and estimation of the spectrum of each endmember until a stopping condition is met."

A combining Sunshine with Keshava would not have rendered the claimed invention to have been obvious. Sunshine (col. 4, lns. 7-18) describes an iterative reduction of the residual mean square. This does not involve a measure of the size of the simplex. Accordingly Sunshine, like Keshava, does not teach the regularization that is included in the claimed invention. In particular, the combination of Keshava and Sunshine would not have rendered obvious a "regularized residual sum of squares (which) comprises the sum of a residual sum of squares and a measure of the size of a simplex" as is required by claim 1.

The claims require that a regularized residual sum of squares include a term which is made of the size of the simplex. This feature is not taught or suggested by the combination of Keshava and Sunshine. Neither Keshava or Sunshine perform

regularization, and in particular neither perform regularization with a term that is a measure of the size of the simplex. By reason of Keshava and Sunshine omitting regularization, none of these claims should have been rejected as being obvious.

3. *Dependent Claim 2 Is Patentably Distinct*

The rejection of dependent claim 2 relies on Keshava (page 54 paragraph 1) which states "quite often the basis for arriving at estimates (of each endmember spectrum) is a distance metric that is minimized." This reference to distance metric is not added to a residual sum of squares so as to comprise the regularized residual sum of squares as required by claim 1. Further, "distance metric" is insufficient as a disclosure of the sum of the squared distances between all the simplex vertices. Since there is no mention of this feature, the invention recited in claim 2 would not have been rendered obvious. New claim 18 also has this feature. Applicant maintains that Keshava teaches away from combining a u fend member determination (that is a part of the shrink-wrap process of endmember determination) with a part of the inversion process (that is the minimization of the square of an error value) to determine the stopping condition in the manner claimed.

4. *Interview Summary and Conclusion*

Applicants appreciate the courtesy of Examiners Park and Kassa during a 45-minute telephone interview conducted on February 25, 2009. An early draft of this response was faxed to the Examiners prior to the interview. During the interview, there was discussion regarding the invention and how it differs from the subject matter

disclosed in Keshava and Sunshine and the proposed amendments to claim 1, and whether the claims define statutory subject matter. At the conclusion of the interview, Examiner Park indicated that it appears the claims define patentable subject matter and are patentably distinct from Keshava and Sunshine. The Examiner also indicated that an additional patentability search for the consideration may be needed before a final determination is made on the allowability of this application.

All claims are in good condition for allowance. Prompt reconsideration and allowance of this application is requested.

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140.

Respectfully submitted,

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